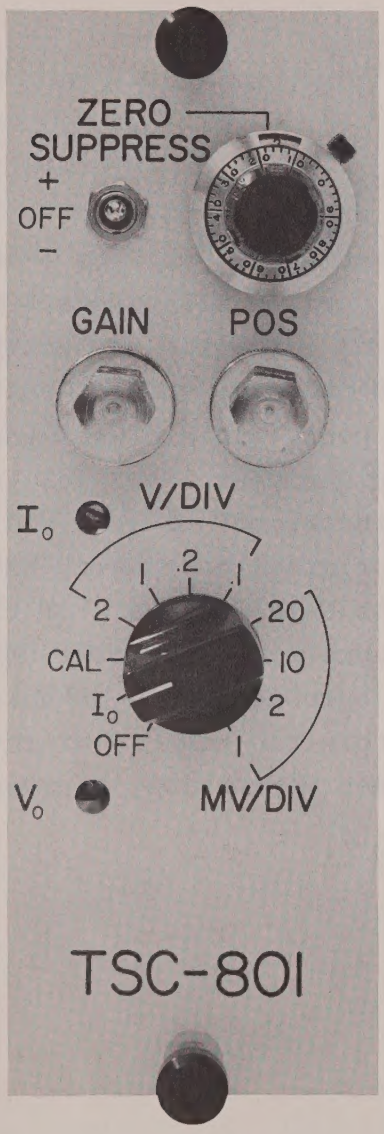
TEST EQUIPMENT FACILITY



Instruction Manual TSC-801

gulton®

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WARRANTY

TECHNI-RITE warrants each instrument to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose, and replacing any defective parts thereof (except pens, tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser, when the instrument is returned transportation charges prepaid by the original purchaser, and which, upon our examination, proves to be defective. If the defect has been caused by misuse or abnormal conditions of operation, repairs will be billed at our current rate. In this case, an estimate will be submitted before the work is started. This warranty is in lieu of all other warranties, expressed or implied.

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LIST OF ILLUSTRATIONS

	DWG.#
Schematic, Preamplifier	401064
Assembly, Preamplifier	401133
Assembly, Attenuator	401103
Assembly, Preamplifier	401110
Schematic, Preamplifier Module	600766

I. DESCRIPTION

A. The TSC-801 is a plug-in Signal Conditioner designed for use with Techni-Rite Recorders, which performs the dual functions of providing calibrated amplification of signals and regulated power to the Amplifier Pen Motor located in the Recorder Main Frame. The TSC-801 can be used interchangeably with the TR-888, TR-444 and TR-7100 model recorders. The TSC-801 accepts AC and DC signal inputs up to 80 volts full scale.

B. The TSC-801 is calibrated for a voltage gain of 10, which provides a nominal system sensitivity of 1 mv/chart division. The input circuit is differential, balanced with respect to frame, and provides excellent common mode rejection. Calibrated zero suppression is provided, which allows the recording of small AC signals which are superimposed upon high DC levels.

C. Specifications, TSC-801

Sensitivity: 1 mv/div, nominal

Input Configuration: 500K ohms ±2%, balanced differential with respect to Frame (may be used single-ended.)

Range Switch: a) Positions: 8 active, from 1 mv/div to 2 V/div

b) Ratio Accuracy: ±½% typical
±1% maximum

c) Other Positions: OFF, Io, CAL

Common Mode Rejection: a) Typical: 60 db

b) Minimum: 48 db

Zero Suppression Accuracy: ±2% of dial reading

Position Control Adjustment: Minimum ±105% of full scale

Internal Calibration Source Accuracy: Settable to better than ±¼%

Baseline Drift: a) 0.2 div/8 hr (typical)
b) 0.5 div/10°C (maximum)

Rise Time: 4 to 5 ms

Recovery Time: 20 ms (maximum)

Sine Wave Frequency Response:

a) DC to 30 Hz, 1 db, at 40 mm peak-to-peak
b) DC to 50 Hz, 1 db, at 20 mm peak-to-peak
c) DC to 125 Hz, 3 db, at 8 mm peak-to-peak

Attenuator Accuracy: The Ratio
Typical ±½%
Maximum ±1%

Calibration Voltage: Set at 200 (±½) mv
Accuracy: ±1% for 6 months
Minimum Adjustment: ±200 (±10) mv

Power Requirement: 115 (±10) VAC, 50 Hz or 60 Hz, 6 watt

Power Supply (+EBB):

1. Output Voltage: ±14.1 VDC Minimum
   ±16.7 VDC Maximum
2. Output Current: 2 ma to 250 ma
3. Output Ripple Voltage: 125 mv RMS maximum at 250 ma load and 105 VAC line.
   20 mv RMS at 250 ma load and 125 VAC line.
   20 mv RMS at 2 ma load and 105 VAC line.
4. Load Regulation: 2.5% from 2 ma load change with constant line voltage.
5. Line Regulation: 1% change per 10 VAC change in line voltage at a constant load.

Operating Temperature: 0 to 50°C Ambient.

Duty Cycles: Continuous for normal operation.

Life (M.T.B.F.): 10,000 hours minimum for normal operation.
Vibration: 3 g's at 2 to 100 Hz.

D. Specifications, TSC-801 with recorder.

Linearity: ±¼ div

Hysteresis: 0.1 div

Noise on trace due to internal causes: 0.1 to 0.2 div

Frequency Response: with 1 ±½ DIV overshoot

The frequency response of the amplifier/pen motor combination is limited by the mass of the pen motor drive coil and associated stylus, and varies for each system application as follows:

TR-888

DC to 30 Hz, 50 DIV. peak-to-peak, ±1 db
DC to 60 Hz, 20 DIV. peak-to-peak, ±1 db
DC to 125 Hz, 10 DIV. peak-to-peak -3 db

TR-444

DC to 30 Hz, 50 DIV. peak-to-peak, ±1 db
DC to 60 Hz, 20 DIV. peak-to-peak, ±1 db
DC to 100 Hz, 5 DIV. peak-to-peak, -3 db

TR-7100

DC to 10 Hz, 50 DIV. peak-to-peak, ±1 db
DC to 18 Hz, 50 DIV. peak-to-peak, -3 db

Rise Time: TR-888 & TR-444

4 to 5 MS for 5 mm peak-to-peak stylus deflection

TR-7100

50 MS for full scale peak-to-peak stylus deflection

Recovery Time:

TR-888 & TR-444 20 msec (maximum)
TR-7100 40 msec (maximum)

Position Adjustment: ±27 DIV. (minimum)

NOTE: Mechanical stylus limits are pre-set at factory between ±26 and ±27 DIV.

Io Offset: Typical: 0.1 DIV.
Maximum: 0.25 DIV.

Vo Adjustment: Set to within 0.1 DIV. (±3 DIV. adjustment minimum)

Noise: Typical: 0.1 DIV.
Maximum: 0.2 DIV.

II. INSTALLATION

A. Mechanical

The TSC-801 plugs into the recorder main frame. To install the TSC-801, hold the module upright and align the top and bottom edges of its printed circuit card with the slots milled into the main frame, or with the nylon P.C. card guides located above the recording channel into which the module is to be inserted. Apply pressure to the left-hand edge of the module front panel and press it firmly into place until the front panel is flush with the face of the recorder. Final seating pressure may be applied to the removal handles located on the top and bottom of the front panel. (Ref: Fig. 1a and 1b)

B. Electrical

All electrical connections are made between module and recorder in A. above, including signal inputs which are routed to connections on the top rear of the recorder.

C. Signal Connection

See Figure 2: The input connector pins are numbered from 1 to 5 counterclockwise starting from the keyway. Make connections according to the table below:

INPUT	PIN NO.
NON-INVERTING (+)	1
FRAME (COMMON)	3
INVERTING (-)	2

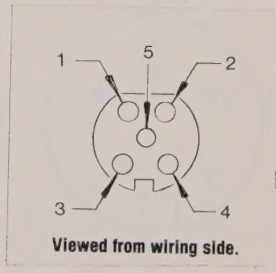


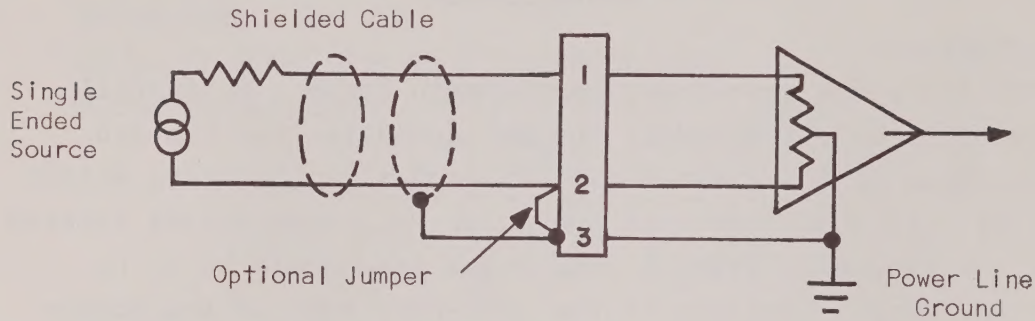
FIG. 2

a) Connect cable shield to pin 3

b) For single-ended use, connect pin 2 to pin 3

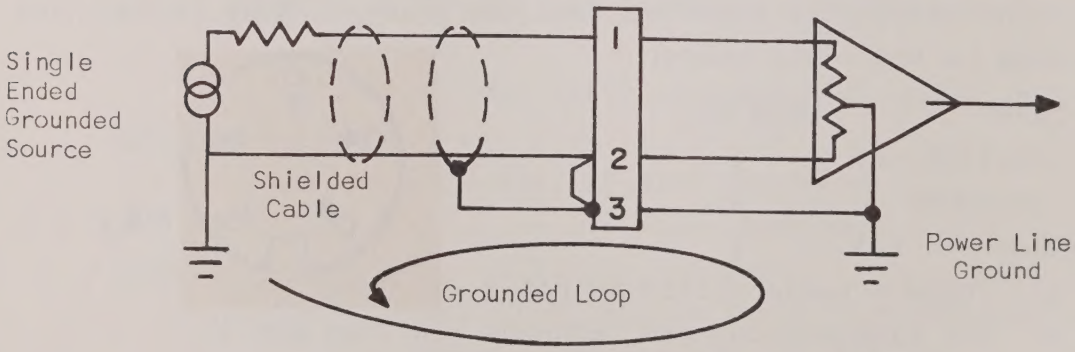
The TSC-801 has two active inputs balanced to ground. This is useful for recording outputs of both single ended and balanced sources.

Recording from a single ended source

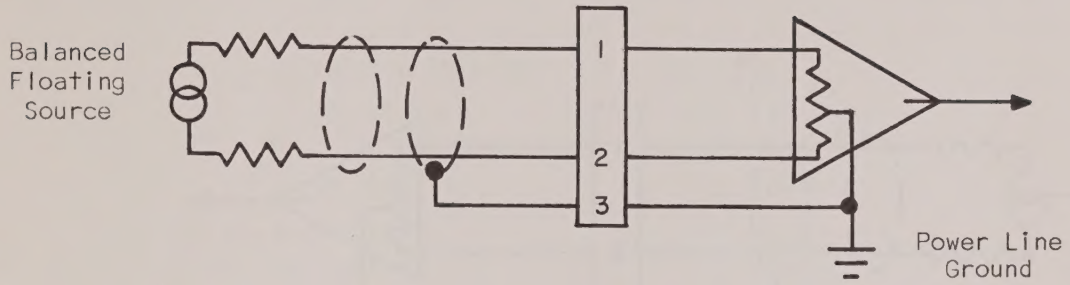


The above diagram shows cabling connections for recording from a single ended floating source. The connections can be reversed if a change in polarity is desired. The shield is connected to the grounded terminal #3. An optional grounding jumper may be installed from either input to the grounded terminal depending on which condition provides minimum electrical noise.

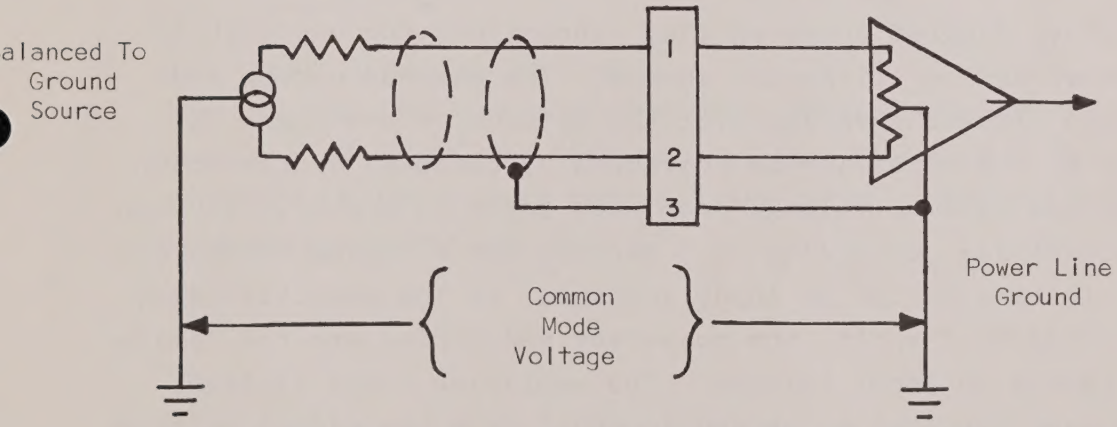
Recording from a single ended grounded source may be done as shown below but is not recommended for low level signals due to the ground loop which could add excessive electrical noise to the recorded signal.



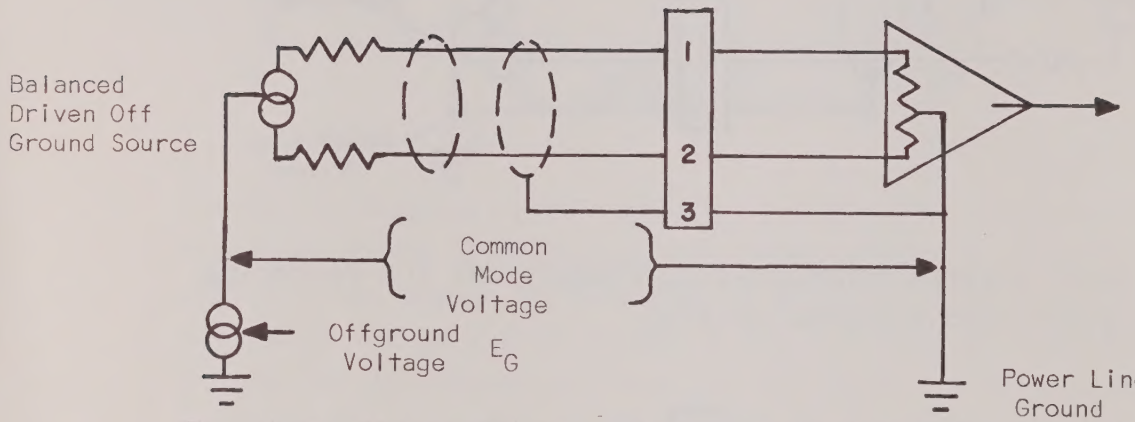
Recording from a Balanced Source



The above diagram shows cabling connections for recording from a balanced floating source.



The above diagram shows cabling connections for a balanced to ground source. The potential difference between the source ground and the recorder power line ground becomes a common mode input voltage which is largely attenuated by the amplifier.



The above diagram shows cabling connections for use with a balanced driven off-ground source. The maximum common mode voltage allowable varies with the attenuator setting. The input to the amplifier is protected by clamping diodes which limit the maximum voltage from each input to ground. At high sensitivities, 20 mv/div to 1 mv/div, the clamping diodes are the limiting factor on input voltage. At low sensitivities, 0.1 v/div to 2 v/div, the connector and wiring are the limiting factor on input voltage. The amplifier input voltage from each terminal to ground is equal to ½ the signal voltage plus the common mode voltage.

$$E_{IN\ MAX} = \tfrac{1}{2}E_S + E_G$$

The maximum input voltage is shown in the following table.

Selector Switch Setting	$E_{IN\ MAX}$ $\frac{1}{2}E_S + E_G$
1 mv/div	5 volts
2 mv/div	10 volts
10 mv/div	50 volts
20 mv/div	100 volts
.1 volt/div	400 volts
.2 volt/div	400 volts
1 volt/div	400 volts
2 volt/div	400 volts

D. Input Connector Wiring

The TSC-801 requires a good quality double-conductor shielded cable, such as Belden 8451 series, for connection from the recorder to the signal source. See Recorder Manual for cable preparation instructions.

III. OPERATION & CALIBRATION

A. Set recorder main frame controls as follows:

1. Turn MAIN POWER on. Allow 15 minutes warm-up.
2. Set CHART SPEEDS switch to 1 or 5 mm/sec.
3. Adjust TRACE WDITH controls for a fine trace on all channels.

B. Calibrate TSC-801 as follows:

1. Turn round locking knobs on GAIN and POSITION controls counterclockwise 1/2 to 2/3 turn to unlock controls, then turn each locking knob clockwise until GAIN and POSITION controls are partially restrained from rotating.

2. Turn GAIN control fully counterclockwise.

3. Using position control, set trace drawn by recorder stylus precisely to the center line of its channel (directly below the signal conditioner).

4. Turn GAIN control fully clockwise. If the stylus moves from its center position by more than 2/5 of the smallest chart division, reset it to channel center line by means of the screwdriver adjustment - Vo trimmer located behind its front panel access hole marked "Vo".

5. Set function switch to Io position. Set screwdriver adjusted Io control through its identified front panel access hole for a "Null", the point at which the recorded trace most closely approaches the channel center.

6. Set function switch to CAL (calibrate) position. Set GAIN control to the position which causes the stylus to trace a line precisely 20 smallest chart divisions to the right of the channel center. NOTE: 20 divisions are <u>not</u> equivalent to the end scale deflection, which is 25 divisions.

7. Return function switch to the OFF position and verify that the stylus is tracing a line at exactly channel center. Correct if necessary, by means of the position control.

8. Repeat steps 4. and 5. until stylus traces precisely at channel center in OFF and at +20 chart divisions in the CAL positions of the function switch.

9. The signal may now be connected to the signal conditioner. The position control and range switch may now be set any position within their respective ranges of adjustment.

10. HOW TO USE ZERO SUPPRESSION:

a) Zero suppression is a calibrated 10-times full scale electrical position control at all settings of the function switch.* The purpose of 10 X full scale zero suppression is to allow expanded-scale recording of small AC signal components which are riding on top of a large DC component.

b) First record the signal to be investigated without using zero suppression. And note the approximate peak-to-peak amplitude of the AC signal component as well as that of the DC component. To save chart paper, a calibrated oscilloscope may also be used for this purpose. If the recorder itself is used for this purpose, best results will be attained by using a margin zero, that is, by initially setting the baseline of the trace at the left or right hand margin of its channel (depending upon whether the DC component is positive or negative, in that order.) Naturally, this initial setting should be made with the function switch in the OFF position.

c) Refer to the table below for suggested practical attenuator settings for various combinations of DC and AC components.

d) If a positive DC component is to be suppressed, set the zero suppress switch to "+"; for a negative component, set the switch to "-".

e) Choose and record the type of "zero" (channel center or margin) which is to be used. Set this "zero" with the POS control with function switch in OFF position. DO NOT

*practical limit: 450 volts - See table below

TOUCH POSITION CONTROL THEREAFTER, as all readings will be taken from this initial "zero".

C. ZERO SUPPRESSION TABLE

FUNCTION SWITCH SETTING	MULTIPLIER MV/DIV or V/DIV	EFFECTIVE FULL-SCALE SENSITIVITY (MAX AC COMPONENT)	ZERO SUPPRESSION FOR ONE FULL TURN OF Z.S.DIAL	MAXIMUM ATTAINABL ZERO SUPPRESSION (MAX DC COMPONENT
1	mv/div	50 mv(±25mv E.S.)	50 mv	500 mv
2	mv/div	100 mv(±50mv E.S.)	100 mv	1 volt
10	mv/div	500 mv(±250mv E.S.)	500 mv	5 volts
20	mv/div	1 volt(±500mv E.S.)	1 volt	10 volts
.1	volt/div	5 volts(±2.5v E.S.)	5 volts	50 volts
.2	volt/div	10 volts(±5v E.S.)	10 volts	100 volts
1	volt/div	50 volts(±25v E.S.)	50 volts	450 volts MAX (4.5 turns)
2	volts/div	100 volts (±50v E.S.)	100 volts	400 volts MAX (4.0 turns)

How to use Zero Suppression table

Examples:

35 mv peak-to-peak AC component riding on +750 mv DC level:

Function Switch: 2 mv/div position

Zero Suppress Switch: + position

Zero Suppress Dial: 7.50 turns(7.5 turns @100 mv/turn: 750 mv)

Recorded Signal Amplitude: 17.5 chart divisions peak-to-peak

2.0 volt peak-to-peak AC component riding on -40 volt DC level:

Function Switch: 0.1 v/div position

Zero Suppress Switch: - position

Zero Suppress Dial: 8.0 turns (8.0 turns @5 v/turn: 40 V)

Recorded Signal Amplitude: 20 chart divisions peak-to-peak

IV. PRINCIPLES OF OPERATION

A. Introduction

The Model TSC-801 Signal Conditioner controls the input signal and the stylus in the particular channel that it is used in the recorder.

1. Model TSC-801

The Model TSC-801 Signal Conditioner Module has a DC gain of ten (10) and a balanced differential input. This yields a system sensitivity of 1 mv/div. The balanced input attenuator shows a constant impedance of 500 K ohms to each input. Steps 4 through 11 on the attenuator switch, labelled V/DIV & MV/DIV, provide selectable signal input attenuation. Note that the TSC-801 has inputs marked "+" and "-" on the schematic. A positive signal applied to the "+" input causes the stylus to move to the right. A positive signal applied to the "-" input causes the stylus to move to the left. The Model TSC-801 features zero suppression.

B. Signal Input

The Module signal input presents a constant 500 K load to the signal through nine positions located on positions 3 through 11 of the function switch. The signal, referenced against common, passes through R7 to diodes CR2 and CR3, which limit signal voltage to a safe value to avoid severe accidental overload at the input of the attenuator. If an overload occurred, the excessive signal voltage would be dropped across R7.

Q1, the input pair, presents a very high 30 to 50 megohms load to the input attenuator, to keep attenuator loading to a minimum, and to maintain accurate attenuator ratios. This circuit portion,(Q1, R4, R6, R8, R9) has a voltage gain of unity. R9 maintains a zero-input zero-output condition. R4 reduces the Io leakage from the first transistor in Q1 to a level which causes less than 0.2 division of stylus shift when fully rotating the function switch. The Io flow would produce a false signal at the input of Q1 which would vary between 1 K and 500 K ohms as the function switch is fully rotated.

C. Power Supply (Model TSC-801

The center-tapped secondary of a power transformer feeds full-wave rectifier bridge module CR4, whose outputs yield a positive and a negative voltage with respect to the power transformer center tap. These raw DC outputs are smoothed by C3 and C4 and then pass to Q2 and Q3. The positive voltage regulator, (CR3, R27, Q3) is assembled into a series regulator similar to an emitter follower whose base voltage and emitter (output) voltage is fixed by zener diode CR3 at 16 volts ±5%. Zener current is supplied through R27 from the unregulated supply. CR3 is a 5% accurate device, and the resultant output voltage is 16 VDC less the 0.6 base to emitter drop in Q3, or 15.4 VDC ±5% in the lightly loaded condition.

D. Signal Input Zero Suppression Circuit (Dwgs. 600766 & 401064) - Model TSC-801

Function switch S2 has two active decks, S2A and S2C; S2B is used for tie points. The S2C selector feeds the non-inverting input and the S2A selector feeds the inverting input of the module preamplifier section. Interposed between the S2A selector and the preamplifier is R32.

R32 is a ten-turn precision potentiometer, an adjustable element in the voltage divider circuit R31, R32, and R33. This voltage divider is supplied by 2.7 volt mercury battery B1 through S3. R33 brings the maximum voltage across R32 to a level of 10 times the maximum (±25 (50) mv) signal from the attenuator (500 mv). R32, B1, and S3 allow a signal of up to 10 X full scale sensitivity of the system to be brought into range at all function switch positions.

E. Input Protection Circuit (Dwg. 401064)

The input protection circuit, R15, D1 and D2 are the non-inverting input of the module preamplifier section. Diodes D1 are connected across the + and - inputs of the preamplifier and are back-biased at -7.5 volts through the voltage dividers R19 and R22. Diodes D2 and D3 connect the + and - preamplifier inputs and are similarly biased at +7.5 volts. Any input voltage above +8.0 volts will be shunted to common. Excess signal levels above 8.0 volts will be dropped across R15 and/or R16.

F. Input Matching Circuit & Io Adjustment

Input pair Q1 form a pair of emitter followers which present a very high input impedance. The Q1 collectors connect to the +15.5 VDC regulated supply and the emitters connect through their load resistors R10 and R11 to the -15.5 VDC regulated supply of the module. The effective input impedance at both Q1 bases equals the value of R10 or R11 multiplied by the current gain of

its associated transistor in Q1. Since the current gain of Q1 lies in the range of 100 to 250Kohms, and R10 and R11 have a resistance of 500 K ohms, the input impedance at the Q1 bases will be 50 to 125 megohms. The Q1 outputs are limited in amplitude by D1 through D4 to approximately ±8 volts referenced to common.

Io adjustment potentiometer reduces the Io leakage currents from the Q1 bases to a minimum, or to where Io leakage is the same from each base. Otherwise, this unbalanced current leakage from the bases would appear as a deflection of the recorder stylus where no input signal is present. Io control, R23, R18 and R25, balances current flow into the bases of Q1 through R14 and R24.

G. Voltage Gain Stage

The gain of the integrated operational amplifier A1 is set by the value of R8 (Rf) and R12 (Rs) by the ratio Rf/Rs. In this case, Rf = 200 K ohms, and Rs = 20 K ohms, yielding a DC gain of 10. Since the sensitivity of the integrated amplifier pen motor is approximately 8 mv/div., the net maximum sensitivity of the recorder channel is 0.8 mv/div. R9 and R7 match R12 and R8 in value to present a balanced load to the outputs of Q1. R17 adjusts the operational amplifier for zero output with zero input. R6, C1 and C2 are used for frequency compensation. R5 is necessary to prevent "latch-up" of the operational amplifier. The gain control potentiometer connects the output pin (6) of the operational amplifier and PC board common, with output taken from the slider of the gain control being fed directly to the signal input of the integrated amplifier pen motor. Position control voltage is derived from a potentiometer connected between the -15.5 and +15.5 VDC regulated supplies. The slider of the position potentiometer connects to the position signal input of the integrated amplifier pen motor.

H. Stylus Position Control Circuit

The stylus position control potentiometer connects between the +15.5 and -15.5 V busses on the PC board. The slider of this control connects to the position input of the integrated amplifier pen motor.

I. Gain Control Circuit

The gain control potentiometer connects the output of Q1 and the PC board common. Since the sensitivity of the integrated amplifier pen motor is equal to approximately 8 mv/div., and since Q1 has a gain of one, the rated sensitivity of the system (10 mv/div. is attained when the slider is at 75% of its full scale (270°) rotation. This slider is connected directly to the signal input lead of the integrated amplifier pen motor.

J. Calibration Circuit

Model TSC-801

The calibration voltage circuit comprises CR1, R1, R2, R3 and R4. CR1 is connected to the positive side of the regulated supply through R3. The doubly-regulated voltage at CR1 is divided down to the 200 millivolt level in the divider string R1, R2 and R4. The output of R2 is adjustable over 200 millivolts. This voltage is divided at the function switch by a further factor of 10, and the resultant 20 millivolts is made available for calibration at position number 3 of the function switch.

V. PREVENTIVE MAINTENANCE

A. Periodic Maintenance - Mechanical Check

These TSC checks are generally recommended every 500 hours of operation or every three to six months, as determined by experience. They may also be used for preliminary troubleshooting; but because of the mercury battery used in the zero suppression circuit, the battery and zero suppression voltage should be checked whenever the unit is being calibrated. See Section 1 Specifications.

1. Preliminary

Turn OFF all power to the recorder. Remove the signal conditioner by grasping the top and bottom black knobs and then pulling the signal conditioner straight out.

2. Cleaning

Blow out dust and dirt with an air hose. Inspect for foreign particles. Clean the preamplifier panel and knobs with a moist cloth, then wipe dry with a soft, dry cloth. Occasionally rotate each knob through its full scale. This keeps all contacts clean.

3. Inspect for Tightness

Inspect the signal conditioner and power supply for loose transistors, plug-in components, resistors, capacitors, controls, terminal boards, mounting boards, rectifiers, fuses, transformers, etc. Check that all panel-mounted components are securely in place, that all locking controls will lock securely, and that each knob is tight on its shaft.

4. Inspect for Damage

Inspect visually and by smell for burned or worn insulation, leakage, or damaged resistors, capacitors, transformers, etc. Inspect also for corrosion, rust, and electrical or mechanical abuse.

5. Replace

Reinstall the equipment and fasten securely.

VI. TROUBLESHOOTING (TSC-801) (Dwg. 401064)

SYMPTOMS	CHECK
NO POSITION, NO OUTPUT	1. Channel fuse 2. Board connection 3. Power supply a. The output of CR4 is approximately 45 VDC and if not, check CR6, C1 and C2. b. TP10 to TP7 - 16 VDC; if not, check CR2, R26 and Q2. c. TP11 to TP7 +16 VDC; if not, check CR3, R27 and Q3. 4. If problem still persists check amplifier circuitry for shorts and check the recorder.
POSITION, BUT NO OUTPUT	1. TP11 to TP7, if no signal check connections and D1 - D4. 2. TP6 to TP7, if no output check Q1, AR1 and associated circuitry. 3. TP4 to TP7, if no gain check potentiometer.
OUTPUT BUT NO POSITION. NOISE ON LEFT SIDE.	1. R113 for open. 2. TP10 to TP7 with an oscilloscope for AC ripple; also C4 and/or CR2. 3. Input clamps D1 to D4.
NOISE ON RIGHT SIDE	1. TP11 to TP7 with an oscilloscope for AC ripple. a. C3 and CR3 2. Input clamps D1 to D4.
UNABLE TO ADJUST CAL	CR1, R1 to R4.

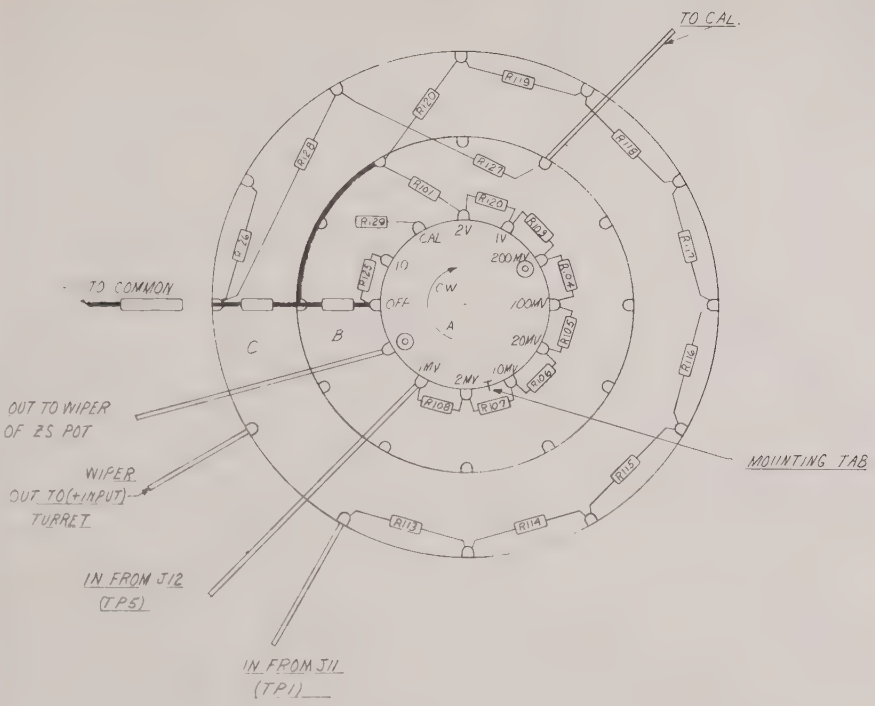
VII. PARTS LIST - Model TSC-801

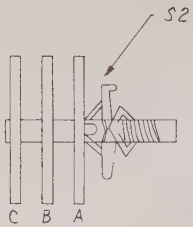
Ref. Desig.	Dwgs. 401133, 401110, & 401103 Description	Techni-Rite Part No.	Mfr.	Mfr. P/N	Units per Ass'y
A1	Amplifier	104296-1	Solitron	UC709C	1
BB1	Battery Assembly	1-102118	Mallory	TR132RT2	1
C1	Capacitor 200 PF	100484-201	*	-	1
C2	Capacitor 3300 PF	100484-332	*	-	1
C3, C4	Capacitor 530 MF	104131	*	-	2
CR1	Diode, Reference	104154	Motorola	IN935	1
CR2,CR3	Diode, Zener	106696-16	Unitrode	-	2
CR4	Diode, Bridge	103533	Motorola	MDA9204-2	1
Q1	Transistor Dual	104297	Union Carbide	2N4045	1
Q2	Transistor	103846	Motorola	2N4919	1
Q3	Transistor	103833	Motorola	2N4922	1
R1	Resistor 1K	100549-1001	*	-	1
R2	Potentiometer 500 ohm	103954-501	*	-	1
R3	Resistor 698 ohm	100549-698R	*	-	1
R4	Resistor 51.1 K	100549-5112	*	-	1
R5	Resistor 100 ohm	100549-100R	*	-	1
R6	Resistor 3.0 K	100556-302	*	-	1
R7, R8	Resistor 1 meg	1-100549-1004	*	-	2
R9, R12	Resistor 100 K	1-100549-1003	*	-	2
R10,R11	Resistor 499 K	100549-4993	*	-	2
R13	Resistor 249 K	100549-2493	*	-	1
R14,R24	Resistor 300 M	101880-307	*	-	2
R15,R16	Resistor 100 K	100550-1003	*	-	2
R17,R23	Potentiometer 50 K	103954-503	*	-	2
R18,R25	Resistor 10 K	100549-1002	*	-	2
R19,R20, R21,R22	Resistor 5.1 K	100556-512	*	-	4
R26,R27	Resistor 180 ohms	100558-181	*	-	2
R32	Potentiometer	101954-502	Bourns	-	1
R101,102, 119, 120	Resistor 249 ohms	100549-2490	*	-	4
R103,118	Resistor 2 K	100549-2001	*	-	2
R104,117	Resistor 2.49 K	100549-2491	*	-	2
R105,116	Resistor 20 K	100549-2002	*	-	2
R106,115	Resistor 24.9 K	100549-2492	*	-	2
R107,114	Resistor 200 K	100549-2003	*	-	2
R108,113	Resistor 249 K	100549-2493	*	-	2
R125,126	Resistor 124 K	100549-1243	*	-	2
R127	Resistor 90.9 K	100549-9092	*	-	1
R128,129	Resistor 10 K	100549-1002	*	-	2
R130,131	Potentiometer	102008-203	Clarostat Mfg.	-	2
S2	Switch, Rotary	103388	CTS	212-3	1
S3	DPDT Switch	106015	Alco Switch	MST-205P	1

Note: - All Resistors Part No. 100549 are 1% ¼ WMF
100556 are 5% ¼ WCC
100550 are 1% ½ WMF
100558 are 5% 1 WCC
101880 are ±10% 0.5 WCC

* See your local distributor.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER PRINT	4-26-73	30787





DWG SIZE	CODE IDENT	SPECIFICATIONS	REF DESIGN	QUAN REQ	FIND NO.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			R108, 113	2		100548-2493	RESISTOR 1/8 W MF, 249 K
			R107, 114	2		100548-2003	RESISTOR 1/8 W MF, 200 K
			R106, 115	2		100548-2492	RESISTOR 1/8 W MF, 24.9 K
			R105, 116	2		100548-2002	RESISTOR 1/8 W MF, 20 K
			R104, 117	2		100548-2491	RESISTOR 1/8 W MF 2.49 K
			R103, 118	2		100548-2001	RESISTOR 1/8 W MF, 2 K
			R102, 119	2		100548-2490	RESISTOR 1/8 W MF, 249 OHM
			R101, 120	2		100548-2490	RESISTOR 1/8 W MF, 249 OHM
			R127	1		100548-9092	RESISTOR 1/8 W MF, 90.9 K
			R129, 128	2		100548-1002	RESISTOR 1/8 W MF, 10 K
			R125, 126	2		100548-1243	RESISTOR 1/8 W MF, 124 K
			S2	1		1-104951-3	SWITCH ROTARY

PARTS LIST

UNLESS OTHERWISE SPECIFIED	
DIMENSIONS ARE IN INCHES: TOLERANCES ON:	
FRACTIONS ± 1/64	TWO PLACE DECIMALS ± .010
ANGLES ± 1°	THREE PLACE DECIMALS ± .005
REMOVE ALL BURRS AND SHARP EDGES DIMENSIONS AND TOLERANCES SHALL BE HELD AFTER PLATING. MACHINE SURFACES TO BE 63 RMS.	
MATERIAL	

DRAWN BY:	DATE
FOISY	2-15-73
CHECKED BY:	
CONTRACTOR CERTIFICATION:	
DESIGN APPROVAL:	
DOCUMENTATION APPROVAL:	

ASSEMBLY-ATTENUATOR

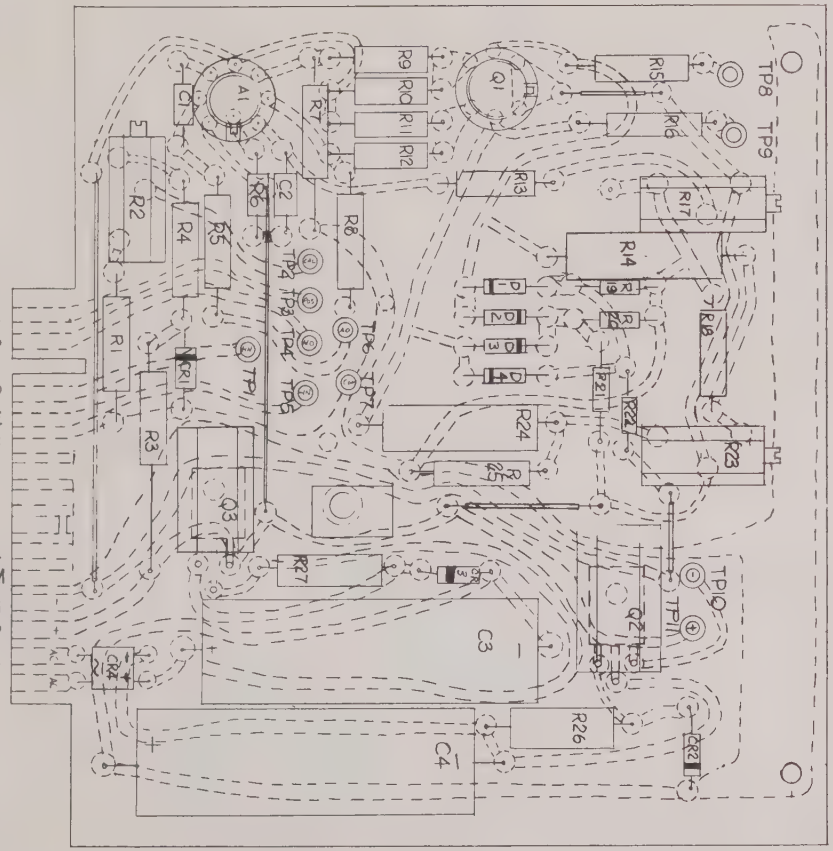
SIZE	CODE IDENT	DWG NO.
C		401103-1

SCALE	CONTRACT NO.	SHEET
-11		1 OF 1

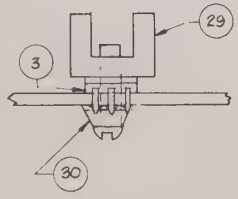
DWG SIZE	NEXT ASSY	USED ON
	APPLICATION	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	REDRAWN	10/69	
	C	REVISED	22 OCT 69	
	D	REVISED TO POT TRACKS	26 FEB 70	20919
	E	REVISED FIND 30/DELETED 104796 DA	30APR 70	21301
	F	FIND 10 WAS 103533 DA	22OCT71	25124
	G	ADDED NOTE #1	5/7/73	31196

* NOTE 1; FIND 1 OP AMP A1 ONLY AUTHORIZED VENDORS ARE
1) DATA DEVICE, 2) FAIRCHILD, 3 NATIONAL SEMICONDUCTOR.



TYP. MOUNTING PROCEDURE FOR POWER TRANSISTORS



USE SILICONE GREASE BETWEEN TRANSISTOR AND HEAT SINK.

DWG SIZE	CODE IDENT	SPECIFICATIONS	SYMBOL	QUAN REQ	FIND NO.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			R18, R25	2	32	100549-1002	RES. ¼ WMF 10 K
				X	31	401064	SCHEMATIC
				2	30		WASHER, CUP SUPPLIED WITH FIND 3
				2	29	104613	HEAT SINK
				2	28	104305	SPACER, TRANSISTOR
			PC1	1	27	104657	P.C. BOARD
			R14, R24	2	26	101880-307	RES. CARBON FILM 300 M
			R26, R27	2	25	100558-181	RES. 1 W CC 180 Ω
			R15, R16	2	24	100550-1003	RES. ½ WMF 100 K
			R19,20,21,22	4	23	100556-512	RES. ¼ WCC 5.1 K
			R6	1	22	100556-302	RES. ¼ WCC 3.0 K
			R17, R23	2	21	103954-503	POT, TRIM 50 K
			R2	1	20	103954-501	POT, TRIM 500 Ω
			R13	1	19	100549-2493	RES. ¼ WMF 249 K
			R10, R11	2	18	-4993	" " " 499 K
			R9, 12	1	17	1-100549-1003	" " MATCHED PAIR 100 K
			R7, R8	1	16	1-100549-1004	" " MATCHED PAIR 1 Meg
			R5	1	15	100549-100R	RES. ¼ WMF 100 Ω
			R4	1	14	-5112	" " " 51.1 K
			R3	1	13	-698R	" " " 698 Ω
			R1	1	12	-1001	" " " 1 K
			CR1	1	11	104154	DIODE, REF. 9V
			CR4	1	10	106080-2	DIODE, BRIDGE
			CR2,3	2	9	101968-16	DIODE, ZENER 16V
			D1,2,3,4	4	8	2-101971	DIODE, SIG. 1N457
			C3, C4	2	7	104131	CAPACITOR 530 μF
			C2	1	6	100484-332	CAPACITOR 3300 PF
			C1	1	5	100484-201	CAPACITOR 200 PF
			Q3	1	4	103893	TRANS. 2N4922
			Q2	1	3	103816	TRANS. 2N4919
			Q1	1	2	104287	TRANS. DUAL 2N4045
			A1	1	1	104296-1	AMP, I.C. 709

* SEE NOTE #1

PARTS LIST

C	401133	TSC-801
DWG SIZE	NEXT ASSY	USED ON
	APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES:
TOLERANCES ON:
FRACTIONS ± 1/64 | TWO PLACE DECIMALS ± .010
ANGLES ± 1° | THREE PLACE DECIMALS ± .005
REMOVE ALL BURRS AND SHARP EDGES. DIMENSIONS AND TOLERANCES SHALL BE HELD AFTER PLATING. 63 MACHINE SURFACES TO BE √ RMS.
MATERIAL

DRAWN BY: C.M. FERGUSON DATE 3 OCT 69
CHECKED BY: J.F. CAYER 6 OCT 69
CONTRACTOR CERTIFICATION:
DESIGN APPROVAL:
DOCUMENTATION APPROVAL:

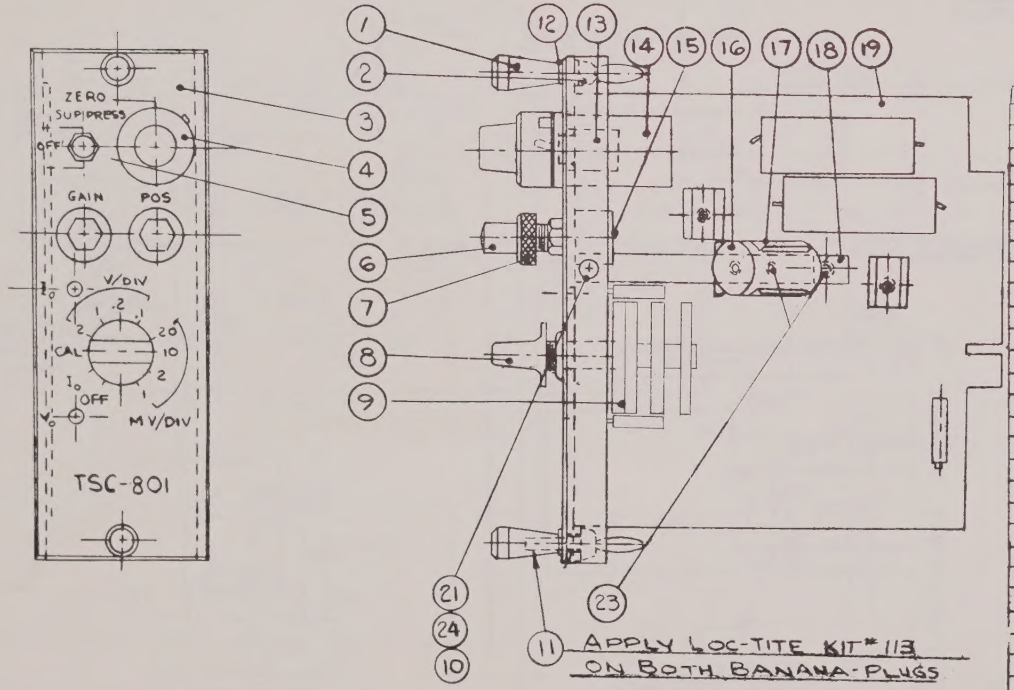
ASS'Y., PRE-AMPLIFIER (TSC-801)

SIZE	CODE IDENT	DWG NO.
C		401110

SCALE 2/1 | CONTRACT NO. | SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DESCRIPTION		DATE	
	B	REDRAWN		6/1/69	
	C	FIND #3 P/N WAS A-1-401095	RLY	7/3/71	23697
	D	CHANGED FIND 7 & 15	J.D.L	9/3/71	24088
	E	FIND 3 WAS A-401942	J.D.L	9/9/71	24055
	F	ADDED FIND 26 & 27	J.D.L	10/22/71	25118
	G	CHANGED FIND 7 & 15	J.D.L	11/11/71	25082
	H	CHANGED FIND 7 & 15	M.T.	2/10/72	24849
	J	ASSY ATTEN WAS 401103		2-24-73	30341
	K	ADDED FD.28-MANUAL		4-3-74	31637

NOTE
MODULE TO BE ALIGND IN FIXTURE
FOR PROPER IN RECORDER.



1	28	1-403	ANTI-
1	27	100556-513	RESISTOR 51K (R33)
1	26	100549-2002	RESISTOR 20K (R31)
X	25	401826	CABLES TSC-801
4	24	#4-40	LOCK WASHER
3	23	#4-40 x 1/4"	RD. HD. SCREW - PHILLIPS
2	22	#4-40 x 3/8	RD. HD SCREW - PHILLIPS
3	21	#4-40 x 1/4	FL HD SCREW - PHILLIPS
X	20	600766	SCHEMATIC (MODULE)
1	19	401110	AMPLIFIER ASS'Y
1	18	104681	STRAP
1	17	102370	BATTERY CLIP
1	16	1-102118	BATTERY ASS'Y
2	15	107148-203	POTENTIOMETER
1	14	101954-502	POTENTIOMETER
1	13	106015	DPDT SWITCH
2	12	104706	NYLON WASHER
X	11	SCREW LOCK	LOCTITE BRG SEV KIT #113
2	10	#4-40	HEX-NUT
1	9	401103-1	ASSEM. ATTEN.
1	8	103575	KNOB
2	7	107149-1	NUT
2	6	102023	KNOB
1	4	101955	MULTIDIAL
1	3	B-401942	FRONT PANEL
2	2	104707	BANANA PLUG
2	1	104705	KNOB-MODULE

DWG SIZE	CODE IDENT	SPECIFICATIONS	QUAN REQ	FIND NO.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/64 | TWO PLACE DECIMALS ± .010
ANGLES ± 1° | THREE PLACE DECIMALS ± .008
REMOVE ALL BURRS AND SHARP EDGES
DIMENSIONS AND TOLERANCES SHALL BE HELD AFTER PLATING OR MACHINE SURFACES TO BE 63 RMS
MATERIAL

DRAWN BY: M.R. LIMA 7 OCT 69 DATE
CHECKED BY: J.F. LAYER 11 OCT 68
CONTRACTOR CERTIFICATION:
DESIGN APPROVAL:
QUALITY ASSURANCE APPROVAL:

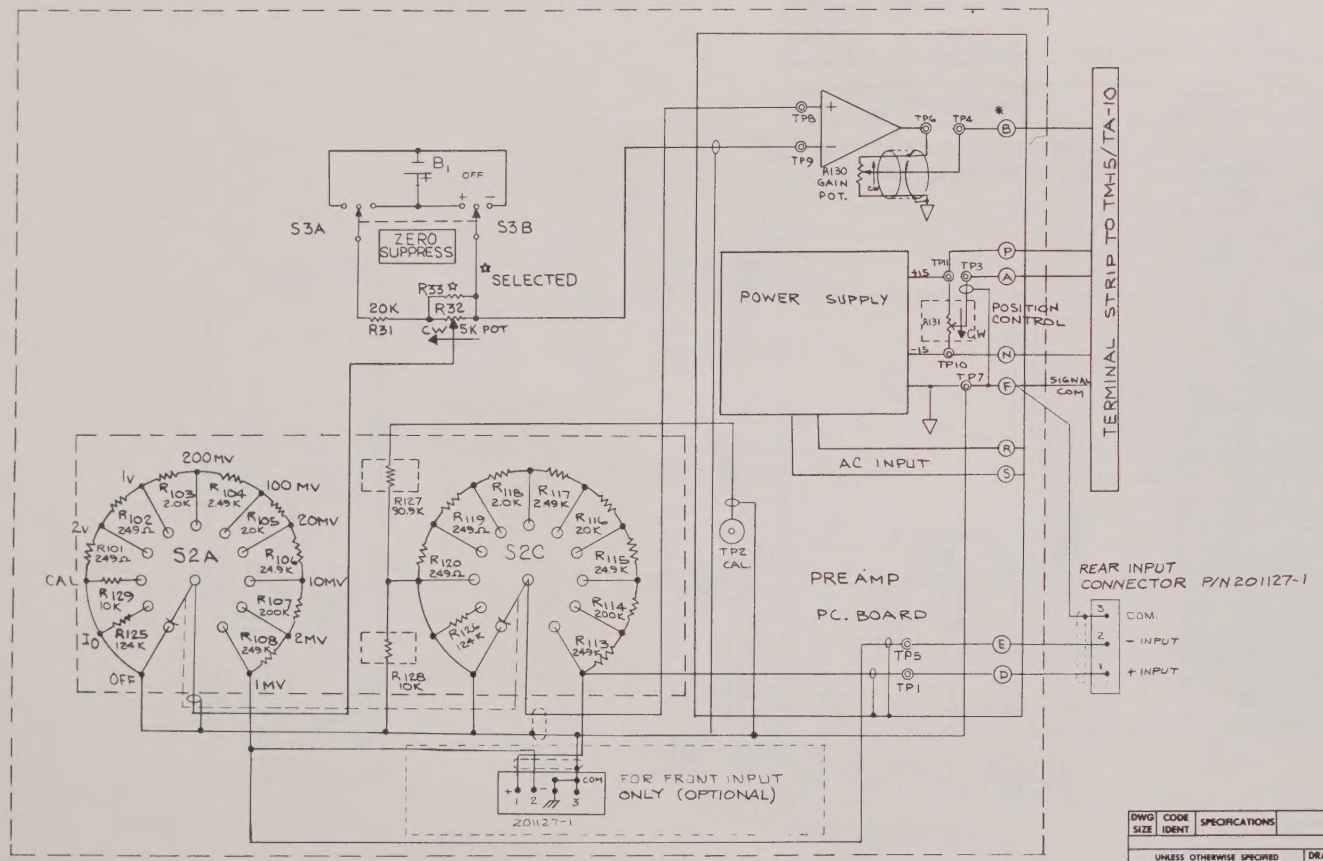
Gulton technifite ELECTRONICS INCORPORATED

ASS'Y. - PRE-AMPLIFIER
(TSC-801)

SIZE C | CODE IDENT | DWG NO. 401133
SCALE | CONTRACT NO.

DWG SIZE	NEXT ASSY	USED ON
E	800066	TR 888
	APPLICATION	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REDRAWN	9/30/69	
	B	REMOVED CONNECTION FROM S3A TO S3C	11/23/71	[illegible]
	C	ADDED R130 & R131 PER ECO	1/31/77	20172



PREAMP MODULE

*CORRESPONDING TO P.C. CONNECTOR PIN

DWG SIZE	CODE IDENT	SPECIFICATIONS	QUAN REQ	FIND NO.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
		PARTS LIST				

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/64 | TWO PLACE DECIMALS ± .010
ANGLES ± 1° | THREE PLACE DECIMALS ± .005
REMOVE ALL BURRS AND SHARP EDGES
DIMENSIONS AND TOLERANCES SHALL BE HELD AFTER PLATING, &3 MACHINE SURFACES TO BE ▽ RMS.
MATERIAL

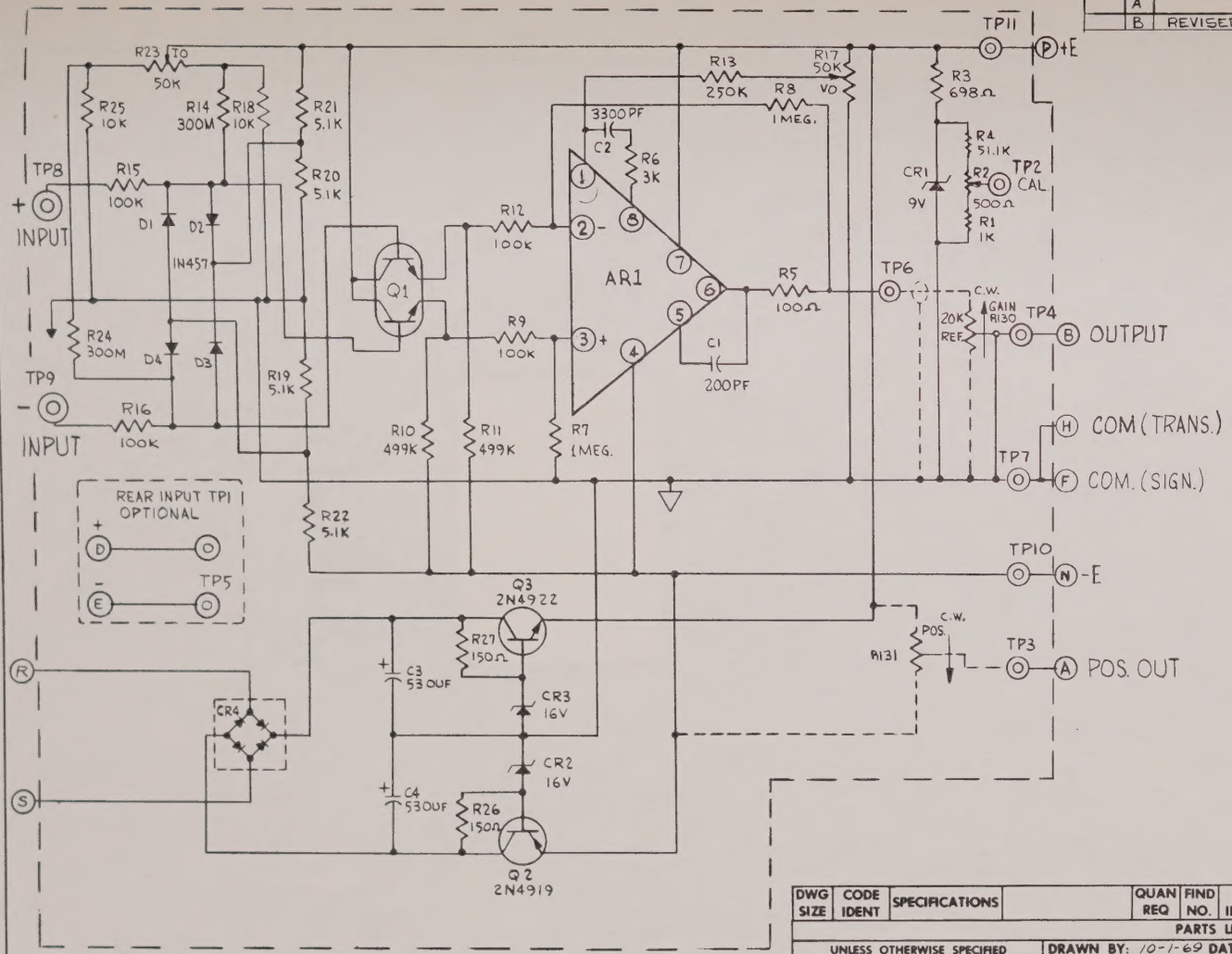
DRAWN BY: S. KAZAMIAS DATE 9/30/69
CHECKED BY: J.F. GAYER 10CT69
CONTRACTOR CERTIFICATION:
DESIGN APPROVAL:
DOCUMENTATION APPROVAL:

SCHEMATIC MODULE
PRE-AMP

SIZE D | CODE IDENT | DWG NO. C00766
SCALE — | CONTRACT NO. | SHEET 1 OF 1

DWG SIZE	NEXT ASSY	USED ON
C	401133	TSC-801
	APPLICATION	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REDRAWN	10-1-69	
	B	REVISED PER MARKED UPPRINT P.A.L.	4-30-70	20172



DWG SIZE	CODE IDENT	SPECIFICATIONS		QUAN REQ	FIND NO.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST							

C	401110	TSC-801
DWG SIZE	NEXT ASSY	USED ON
	APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/64 | TWO PLACE DECIMALS ± .010
ANGLES ± 1° | THREE PLACE DECIMALS ± .005
REMOVE ALL BURRS AND SHARP EDGES. DIMENSIONS AND TOLERANCES SHALL BE HELD AFTER PLATING. 63 MACHINE SURFACES TO BE √ RMS.
MATERIAL

DRAWN BY: C.W. HALL 10-1-69 DATE
CHECKED BY: J.F. CAYER 11 OCT. 69
CONTRACTOR CERTIFICATION:
DESIGN APPROVAL:
DOCUMENTATION APPROVAL:

SCHEMATIC, PRE-AMP. (TSC-801)

SIZE	CODE IDENT	DWG NO.
C		401064

SCALE	CONTRACT NO.	SHEET
NONE		1 OF 1

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Measurement & Control Systems Division
Gulton Industries Inc., East Greenwich, Rhode Island 02818
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